mias during long-term follow-up after ablation of ART in pts with CHD guided by 3-D mapping.

Methods:Pts (n=38, age 38±14 yr., 22 male) with drug-refractory ART and tricuspid atresia (9), transposition of the great arteries (4), atrial septal defect (9), atrio-ventricular septal defect (1), aortic valve stenosis (7), coarctatio aorta (2) and Fallot (6) were studied. Episodes of AF were documented prior to ablation in 2 pts. 3-D activation/voltage maps were constructed during ART (CL 294±79 ms) to locate target sites for ablation. Successful ablation was defined as non-inducibility of the ART after termination during ablation.

Results: Successful ablation was achieved after 1 or 2 (n=7) ablation procedures in 29 (76%) pts. During follow-up (24±6 months), pts had sinus rhythm (n=27, 71%), paroxysmal AF (n=8, 21%) or permanent AF (n=3, 8%). Anti-arrhythmic drugs were used by 33% of the pts with sinus rhythm. The presence of AF was associated with the no. of previous surgical procedures, interval onset arrhythmia - ablation procedure, a higher degree of low voltage areas and a larger right atrial volume ($p<0.01$).

Conclusion: Accurate 3-D localization of target sites is crucial for successful ablation of ART in pts with surgically corrected CHD and improves both short- and long-term outcome. However, during long-term follow-up, AF developed in some pts.

1163-6 Electrophysiological Properties of Atria and Prevalence of Late Atrial Tachyarrhythmias After Orthotopic Cardiac Transplantation

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Background: Orthotopic heart transplantation (OHT) affords a unique model of studying electrophysiological properties of denervated human atria. It has been reported that atrial tachyarrhythmias (AT) maybe a marker of underlying allograft rejection but can also occur in the absence of histologically documented rejection. **Methods:** We prospectively evaluated the long-term corrected sinus node recovery time (cSNRT) and atrial effective refractory period (ERP) in 39 OHT recipients (mean age 46± 10 years); 21 patients (pts) received standard biatrial anastomosis while 18 received bicaval anastomoses. Mean follow-up period was 36±29 months. Incidence of AT during follow-up, which prompted echocardiography, endomyocardial biopsy and electrophysiological assessment, was determined and compared with pts without AT at matched time after OHT (control). **Results**: Thirteen pts (33%) developed 32 episodes of AT: there were 23 episodes of atrial flutter and 8 episodes of atrial fibrillation . Atrial flutter (22/23)occurred predominantly late after OHT (mean period 5.4 ± 4 months). Mean ERP determined at donor right atrium was significantly lower in AT group (AT: 205 ± 20 ms vs control: 234 ± 43 ms; p= 0.05). Permanent pacemaker was required in 3 pts(8%) . The mean cSNRT was significantly prolonged in the AT group (AT 776 ± 121ms vs control 446 ± 187ms, $p<0.01$). With stepwise logistic regression analysis, incidence of AT correlates positively with technique of biatrial anastomoses ($p<0.001$), recipient's age ($p=0.005$) and cSNRT ($p=0.003$) but was not associated with donor's age, ischemic time, left atrial size, ejection fraction and degree of tricuspid regurgitation, right atrial pressure, pulmonary capillary wedge pressure, cardiac output or grade of rejection on endocardial biopsy.

Conclusion : Occurrence of AT, predominantly atrial flutter, is more common in biatrial anastomosis and often in the absence of rejection. Possible mechanisms for late-onset atrial flutter after OHT include presence of anatomical substrate of anastomotic suture between donor and recipient atria, impaired sinus node function and abnormal intraatrial conduction with altered anisotropy after atrial surgery.

1163-7 Three-Dimensional Myocardial Contrast Echocardiography: A Novel Method to Assess Ablation Lesions in Koch's Triangle in Humans

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Background: Myocardial contrast echocardiography (MCE) has been shown to be a feasible method to visualize radiofrequency (RF) ablation lesions in the left ventricle in an animal model. Aim: To test the feasibility of MCE in visualizing ablation lesions in the human right atrium using three-dimensional (3D) myocardial contrast echocardiography. We tested this method to assess RF as well as cryo ablation lesions. Methods: A total of 12 patients who underwent catheter ablation of supraventricular tachycardias were included in this prospective single-blind feasibility study. MCE was performed both at baseline and after ablation using a 9 MHz rotating transducer during continuous venous echocontrast infusion (SonoVue, Bracco). Three-dimensional reconstruction of Koch's triangle was performed before and after ablation in all patients using respiration and ECG gated pullback of the ICE transducer, with and without echocontrast infusion. Two independent observers examined the recordings off-line. 4 out of 12 patients with arrhythmias ablated outside Koch's triangle served as controls. Results: MCE identified ablation lesions as a low contrast area within the normal atrial myocardial tissue. Craters on the endocardial surface were seen in all 8 patients after ablation. Lesions were identified in 7 out of 8 patients (87%). None of the control patients were recognized as ablated. The confidence score of the independent echo reviewer tended to be higher when the number of applications increased. Conclusions: 1, 3D MCE is a feasible method to visualize ablation lesions in human atrial myocardium. 2, Both RF and cryo energy lesions are visible with MCE.

1163-8 Coronary Sinus Activation Pattern in Patients With AV Nodal Reentrant Tachycardia

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Background: Patterns of left atrial (far-field signals) or coronary sinus (CS) muscle (near-field) have been defined in CS recordings. The purpose of our study was to define the activation patterns from CS recordings in patients with AV nodal reentrant tachycardia (AVNRT). **Methods**: The study involved 149 patients (41 ± 22 yr, M 63, F 86) with 155 episodes of AVNRT. AVNRT was divided into 3 patterns: anterior pattern (ANT: 123 tachycardias) the atrial deflection from the His bundle electrogram (HBE) preceded that from the proximal CS electrogram (CSp), posterior pattern (POST: 23) the proximal CS was earlier than HBE and left atrial pattern (LAP: 9) activation within the CS preceded both CSp or HBE. A decapolar catheter was used for the CS recording. The CS electrograms were analyzed with respect to total signal duration as well as the duration of the initial component at a paper speed of 400 mm/sec. An initial slow wave was defined as a duration exceeding 10 ms. Catheter ablation was performed using a standard slow pathway anatomic approach. **Results**: 1) The duration of the initial component for the ANT was longer than that for the POST in CSp (7 ± 3 ms vs. 4 ±2 ms), CS7-8 (7 ± 3 vs. 4 ± 2), CS5-6 (7 ± 3 vs. 4 ± 3) and CS3-4 (7 ± 2 vs. 5 ± 2) ($p<0.01$). 2) Electrogram duration: ANT was longer than POST in CSp (38 ± 10 ms vs. 27 ± 6 ms), CS7-8 (32 ± 7 vs. 27 ± 6), CS5-6 (31 ± 7 vs. 27 ± 5) and CS3-4 (30 ± 6 vs. 25 ± 5) ($p<0.01$). 3) The percentage showing an initial slow wave followed by a rapid activation: ANT was higher than POST in CSp (62% vs. 9%), CS7-8 (79 vs. 0), CS5-6 (72 vs. 0), CS3-4 (54 vs. 9) and distal CS (47 vs. 0) ($p<0.01$). 4) The ablation success rate was lower for LAP (56%) compared with either ANT (98%) or POST (96%) ($p<0.05$). **Conclusions**: 1) The initial slow wave followed by a rapid component was usually observed in the ANT and suggests far-field left atrial activation followed by the CS musculature activation. In a minority this pattern was not present and suggests that multiple mechanisms may be operative. 2) CS analyses for the POST group suggest predominant activation from the right atrium. 3) The low ablation success rate for the LAP suggests the slow pathway region may not be involved in the circuit for these patients.

1163-9 Atrial Tachyarrhythmia Recurrence: Temporal Patterns

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Background. Analysis of atrial fibrillation (AF) temporal patterns has guided proposal or criticism of outcomes measures in clinical studies about AF.

Aim. We performed a prospective multicentre study to describe AF recurrence temporal patterns in patients suffering from brady-tachy form of sick sinus syndrome.

Methods. 100 patients (age 70±3 years; 54% male) from 12 centers were implanted with a DDDRP pacing system (Model AT500, Medtronic, Inc.) including three prevention pacing algorithms (Prev) and antitachycardia pacing (ATP) therapies. One-month post implant Prev and ATP were enabled. Follow up duration was 6 months and during this period antiarrhythmic drug therapy was maintained stable. AT500 extended monitoring capabilities allowed long term measurements of the number of consecutive SR days between atrial arrhythmia episodes. The probability density function (PDF) of consecutive SR days was calculated and fitted by power law or exponential functions for each patient. Results. 36 patients experienced more than 30 AT episodes, which were sufficient for reliable statistical modeling of the SR intervals between episodes. AF temporal patterns were fitted by power law and exponential functions. Fit results were better using a power law function (coefficient of determination equal to 0.81±0.16) in 27/36 (75%) patients, using an exponential function in 6/36 (16.8%) patients. In 3/36 (8.2%) patients power law and exponential function gave comparable results.

Conclusions. AF recurrences in 75% of our patient population were not randomly distributed over time, rather followed a power law distribution. New clinical endpoints, such as the slope of non linear regression of the PDF of consecutive SR days, could be proposed to measure prevention therapies impact on health status of patients having non uniformly distributed AF temporal patterns.

1163-10 Electrophysiological Characteristics of Tachycardias Arising From the Apex of the Triangle of Koch

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Atrial tachycardias originating within the triangle of Koch (AT) pose a diagnostic and therapeutic challenge. These tachycardias closely mimic AV nodal reentrant tachycardia (AVNRT) but the mechanism and approach to catheter ablation differ. The purpose of this study was to evaluate the electrophysiological characteristics of AT arising from the triangle of Koch and to differentiate it from AVNRT

Methods: Of 80 patients referred for catheter ablation of supraventricular tachycardia (SVT), 10 patients were noted to have an SVT arising from the triangle of Koch (7 patients who had AVNRT with 2:1 block and 3 patients who had AT). Right atrial septal mapping was performed in all patients. In 4 patients (3 with AVNRT and 1 with AT), left atrial septal mapping was also performed

Results: The age of the patients was 50 ±16(mean±SD) and the tachycardia cycle length was 322±52 ms (mean±SD). Patients with tachycardia arising from the apex of the triangle of Koch responded to adenosine infusion with high degree AV block. Ventricular pacing resulted in a V-A-A pattern, but did not terminate the tachycardia. In patients with AVNRT, both interventions resulted in termination of the tachycardia. In patients with AVNRT, 2:1 block was seen above or below the His potential recording site, whereas, in AT patients, the level of block was always above the site of the recorded His potential. All patients with AVNRT were cured by ablation at the posterior right septum. In 2 patients with AT, successful ablation was performed at sites showing a His potential on the pre-ablation electrogram without damaging the conduction system. In all cases where left

sided mapping was performed, the atrial signals were earlier on the left side of the septum compared to the right side (AT and AVNRT).

Conclusion: AT arising from the apex of the triangle of Koch tend to show variable AV block with adenosine infusion and a V-A-A pattern with ventricular pacing whereas during AVNRT, AV block was always 2:1 block. AT from the apex of the triangle of Koch required ablation at sites of earliest activation (near the His potential) and probably utilizes unique conduction routes that do not involve adenosine sensitive regions of the AV node.

1163-11 Electrophysiologic and Electroanatomic Characterization of the Atria in Sinus Node Disease: Evidence of Diffuse Atrial Remodeling

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Background: The sinus pacemaker complex is an extensive structure in the RA along the crista terminalis. Limited information exists describing the electrophysiologic changes at this structure and the RA in sinus node disease (SND).

Methods: 16pts (8M, 68±9yrs) with symptomatic SND and no prior atrial fibrillation, and 16 age-matched controls were studied. 20-pole catheters were positioned along the lateral RA, crista and a 10-pole catheter in the coronary sinus (CS). We measured: atrial refractoriness (ERP) at the distal CS, low and high lateral RA and high septal RA at 600, 500 and 400ms, corrected sinus node recovery time, P-wave duration, conduction time (CT) along the CS and lateral RA, and double potentials (DP) at the crista (No. and max^m interpotential duration). RA electroanatomic activation and voltage maps were created using the CARTO system.

Results: SND pts demonstrated: (i) regions of low voltage and electrical silence (scar) particularly distributed along the crista, and (ii) fractionated electrograms and DP cf. controls (39.3±3.7 vs 13.1±1.0% of points, p=0.0002). There was no change in the heterogeneity of ERP.

	SND	Control	p-value
ERP distal CS (600ms)	270.0±11.9ms	261.8±6.2ms	ns
ERP high septal RA (600ms)	297.3±11.0ms	268.7±6.9ms	<0.01
ERP high lateral RA (600ms)	244.4±14.9ms	222.9±7.7ms	<0.05
ERP low lateral RA (600ms)	246.2±15.6ms	225.6±8.8ms	<0.05
CSNRT (600ms)	858.4±109.8ms	261.7±21.8ms	<0.01
P-wave duration	133.9±1.7ms	105.1±1.3ms	<0.0001
CT LRA (600ms)	48.1±1.6ms	40.8±1.4ms	<0.01
CT CS (600ms)	38.5±1.5ms	33.2±0.9ms	<0.01
Mean RA Voltage	1.1±0.1mV	1.9±0.1mV	<0.0001
Crista DP No. (600ms)	4.7±1.1	2.3±0.5	<0.01
Crista DP Max Interpot.Dur. (600ms)	53.3±6.3ms	28.3±6.0ms	<0.01

(Data at 500 and 400ms are consistent).

Conclusion: SND is associated with diffuse atrial abnormalities characterized by (i) structural remodeling with low voltage and scarring particularly at the crista, (ii) widespread and anatomically determined conduction abnormalities, and (iii) increased ERP in the RA. These changes may contribute to increased atrial fibrillation risk.

1163-12 Progressive Orthostatic Hypotension During Tilt Table Test Is Not an Indicator of Underlying Autonomic Dysfunction

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Background: Published reports have considered Progressive Orthostatic Hypotension (POH) during Tilt Table Test (TTT) as an indicator of underlying autonomic dysfunction especially in patients with Diabetes Mellitus (DM), Parkinsonism, severe POH and elderly. The purpose of this study is to elucidate concordance of tilt-induced POH with underlying autonomic dysfunction.

Methods: We reviewed records of 658 consecutive patients from 1/02 to 8/02 who had TTT (ACC/NASPE Guideline) in our Lab at CCF. 84 patients had POH during TTT; 55 of those patients subsequently had autonomic reflex testing (AR) at our Center (using beat-by-beat Finapres BP and EKG). TTT and AR test results of this population were reviewed and compared. POH was defined as a drop of SBP by >20mmHg and a simultaneous drop of DBP by 10mmHg. Severe POH was defined as a drop of SBP by >50mmHg and /or a drop of DBP of >20mmHg or POH within 20min of Tilt.

Results: We found no statistically significant correlation between presence of POH and underlying autonomic dysfunction. This was true for the entire study population as well as for sub-groups including those who had DM, parkinsonism, elderly (age>65), early POH and severe POH.

Results

POH on TTT(Population size)	Sensitivity	Specificity	Positive Predictive value	Negative Predictive value	Co-efficient of concordance (k)	P-value
Total population (55)						
			23	100	0	
		0				1
	100					
Age > 65(39)					0	
			23	100		
	10	0				
	0					1
Severe POH (55)						
			27	93	0.11	
						>0.12
	9					
	2	30				
POH within 20 min					-	
			21	76	0.01	
						>0.83
	67	30				
Associated neurologic conditions including DM(22)					-	
			17	75	0.03	
						>0.69
	75	17				

Conclusion: The presence of POH during TTT is a poor indicator of underlying autonomic dysfunction. Tilt-induced POH is not diagnostic of autonomic dysfunction even in high-risk patients including those with diabetes, parkinsonism, severe POH, and elderly.

POSTER SESSION

1164 Applications of New Electrocardiographic Techniques

Tuesday, April 01, 2003, 9:00 a.m.-11:00 a.m.
McCormick Place, Hall A
Presentation Hour: 10:00 a.m.-11:00 a.m.

1164-1 Newly Developed High Frequency QRS Electrocardiograph in the Detection of Coronary Disease

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Background: We tested the ability high frequency QRS electrocardiography (HF QRS ECG) to noninvasively identify uncomplicated coronary artery disease (CAD). Using an advanced 12-lead PC ECG software program recently developed at NASA, we first prospectively tested the existing HF QRS ECG criteria of Abboud et. al. for identifying CAD — i.e., the presence of morphologic reduced amplitude zones (RAZs) in any two of leads V3, V4 and V5. At the same time, using an initial subset of 23 (of a total of 69) patients examined, we retrospectively developed new criteria for a positive HF QRS ECG test that evaluated RAZs across all 12 ECG lead positions rather than across just three ECG lead positions.

Methods: Three hundred signal-averaged ECG beats were obtained from each of 69 patients who underwent elective cardiac catheterization for evaluation of chest pain. Significant CAD was considered present when stenosis ≥50% was identified in at least one major coronary artery and/or in a graft to a major coronary artery. Patients with arterial collaterals ≥grade 2 to a singularly diseased culprit vessel (n=2), QRS interval >120 ms (n=10), heart failure (EF < 40% and/or diastolic dysfunction, n=10), previous myocardial infarction (n=13), left ventricular hypertrophy (n=13), atrial fibrillation/flutter (n=2) and/or prior pacemaker insertion (n=1) were excluded from the study.

Results: In the 20 patients remaining who qualified for the study, the 3-lead HF QRS ECG criteria of Abboud et. al. correctly identified the presence of CAD in 7 of 9 individuals who ultimately had positive catheterization results (77.7% sensitivity) and the